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## Description

## Method and device for the production of a fancy yarn

The invention relates to a method for the production of a fancy yarn according to the preamble of claim 1 and a device according to claim 14.

A yarn in which thick locations are present with predetermined larger diameters and with predetermined lengths, the so-called effects, is called a fancy yarn. The yarn sections located in between, with a smaller diameter, in other words the effect-free sections, are called webs. Fancy yarns are becoming more and more important. Areas of application are, for example, denims, materials for casual clothing and home textiles.

Fancy yarns can also be produced on rotor spinning machines. In this case, the fibre feed to the opening roller of the rotor spinning mechanism is changed, for example, in that the speed of the draw-in rollers is varied. For this purpose, mechanical gearings are activated, which drive shafts extending along the length of the machine. These draw-in rollers are made to rotate by means of the shafts. However, owing to the large mass of the moved parts of a drive system of this type and the gearing play, an exact and abrupt change in the yarn thickness at the beginning and end of an effect cannot be achieved, or only with difficulty. The speed during the spinning of fancy yarn optionally has to be sharply reduced when spinning fancy yarn compared to the speed when spinning effect-free yarn.

DE 44 04 503 A1 describes a rotor spinning machine, in which each draw-in roller with its drive shaft is directly connected to an associated stepping motor. Each stepping motor can be activated via an activation unit. Random speed changes of the fibre band draw-in can be generated with a random generator. A fancy yarn with predetermined effects cannot be produced with this known rotor spinning machine. The disadvantage of yarns produced by means of a random generator is primarily that patterns are unintentionally produced in the textile surface by the random production.

However, in the meantime programmes for controlling ring or rotor spinning machines, in particular their supply cylinders have been developed, with which effects can be adjusted in a targeted manner (see for example DE 40 41 301 A1).

It is known to store the effect data of previously produced fancy yarns, in order to be able to produce a yarn again with the same effects at a later instant. However, if a fancy yarn exists, which was produced, for example with a ring spinning machine but is now to be produced on a rotor spinning machine with a substantially similar effect specification, the effect and setting data available cannot be directly transferred.

The effect data includes, in particular, the effect lengths, effect diameters, the effect frequency and the respective effect-free thread length or web length.

The object of the invention is to propose a method and a device, which make the reproducibility of a previously produced fancy yarn possible.

This object is achieved with a method with the features of claim 1 and a device with the features of claim 15.

Advantageous configurations of the invention are the subject of the sub-claims.

By means of the method according to the invention, all the essential data for the further production of a fancy yarn is collected and brought into a form which makes it possible to produce the presented yarn, regardless of what type of machine it was previously produced on, for example even to produce it on a rotor spinning machine, with the characteristic effect structure substantially being recognisable again.

Claims 2 to 10 claim the details of determining the effect formation, which result from the transverse dimension values which have been supplied by a measuring mechanism. The important factor above all is to determine regularities in the repetition of effect lengths and dimensions including their repeat length and to eliminate effect-independent irregularities. Only thereby is a reproduction of the model effect possible.

If a check on the effect achieved is carried out according to claim 11, an adjustment may take place until adequate agreement is achieved with the original yarn. In other words, it is possible according to the present invention to check, in a plurality of cycles, the result of the respective change in parameters and to initiate a change again. In this manner, the yarn can very closely approach the original yarn. Checking of the agreement may take place either by statistical detection, in particular detection of the effects by tables, in other

words, their thickness, length and distribution or else their visual presentation, as is known, for example, by means of the Oasys® system from Zweigle. In the simplest case, the yarns may be directly compared visually.

The reproducibility of this yarn is very good owing to storage of the data according to claim 12 after adjustment.

In the adaptation to the original yarn, according to claims 13 and 14, spinning settings also have to be taken into account that relate to the base setting of the machine, which do not vary like the directly effect-related data with the varying transverse dimension of the yarn. Thus, for example, the thickness of the yarn section may be changed by changing the twist factor. The combing out power of the opening roller influencing the effect is determined both by the type of fittings and the peripheral speed of the opening roller.

The data to then be resupplied to the rotor spinning machine is effective for various control mechanisms. Accordingly, the data contains addresses of control mechanisms, for which it is intended. On downloading, this leads to the intended allocation of the data.

In this case, data is also included, which is merely brought to a display of the central control mechanism for display. This relates, in particular to data, which cannot be converted by the machine itself. An example is the necessary number of spinning means.

A device according to the invention for carrying out the method according to claim 15 to 17 consists of a plurality of

mechanisms, which are alternatively connected to the spinning machine or are operated separately from one another. In either case, these mechanisms are alternatively connected via data lines to the control mechanisms of the spinning machine or available by means of transportable data carriers for the control mechanisms.

The invention will be described with the aid of a rotor spinning machine.

In the drawings:

Fig. 1 shows a schematic view of a spinning station,

Fig. 2 shows the opening mechanism of a spinning station in a simplified schematic view, in a partial view,

Fig. 3 shows a schematic view of the control, in particular of draw-in rollers of a rotor spinning machine,

Fig. 4 shows a fancy yarn, which is shown by the arrangement side by side of measured values of the yarn diameter and

Fig. 5 shows the schematic view of a yarn effect.

Of the large number of spinning stations of a rotor spinning machine, a single spinning station 1 is shown in side view. At the spinning station 1 a fibre band 3 is drawn by a so-called compressor 4 into the spinning box 5 of the rotor spinning mechanism from a fibre band can 2. The mechanism arranged in the spinning box 5 for separating the fibres and feeding them into the spinning rotor 6 are known from the prior art and

therefore not described in more detail. The drive of the spinning rotor 6 is indicated and consists of a belt 7 extending along the machine, with which all the rotors of the spinning stations installed on one longitudinal side of the spinning machine are driven. Alternatively, individual drives of the rotors are also possible, however. The belt 7 rests on the rotor shaft 8 of the spinning rotor 6.

The thread 9 is formed in the spinning rotor 6 and is drawn off through the spinning draw-off tube 10 by means of the draw-off rollers 11. The thread 9 then passes a sensor 12, the so-called cleaner, for quality monitoring of the thread. The thread 9 is guided by a thread guide 14 in such a way that it is wound in cross-wound layers onto a cross-wound bobbin 15. The cross-wound bobbin is carried by a bobbin holder 16, which is pivotably mounted on the machine frame. The cross-wound bobbin 15 rests with its periphery on the winding drum 17 and is driven thereby such that the thread 9 is wound in cross-wound layers in cooperation with the thread guide 14. The directions of rotation of the cross-wound bobbin 15 and the winding drum 17 are indicated by arrows. The sensor 12 is connected to a local control unit 20 of the spinning station via the line 18. The control unit 20 is connected to a central computer 22 of the rotor spinning machine via the line 21. The stepping motor 23 of the draw-in rollers is connected to the control mechanism 25 via the line 24.

Fig. 2 shows details of the opening of the fibre band 3 into individual fibres. The fibre band 3 drawn in by the compressor 4 is clamped between the clamping table 26 and the draw-in roller 27 and presented to the rapidly rotating opening roller 28. The draw-in roller 27 is connected to the stepping motor

23 via the drive connection 29. The stepping motor 23 can be activated by the line 24. The direction of rotation of the opening roller 28 is indicated by the arrow 30.

The schematic structure of a draw-in roller control is shown schematically in Fig. 3.

The measuring mechanism 31 described in the present example measures the diameters of the presented yarn. Alternatively, the yarn mass could be determined, for example, by means of a capacitive sensor instead of an optical sensor. In determining the yarn mass, which is generally used as a basis for the determination of the yarn fineness, the mass of a yarn section passing the measuring region is measured, while in an optical measurement, an average diameter value is determined inside the measuring region. Both measurements are equally suitable for evaluation of the effect formation. In the present example, however, the invention is described with the aid of the diameter determination.

Initially, the original yarn is supplied to the schematically shown measuring mechanism 31 which detects the measured diameters in relation to the thread length running through and transmits this data to an evaluation mechanism 32' of a yarn design unit 32. The transmission is indicated by the arrow 33. The effect data is formed in the evaluation mechanism 32A from the measured values. The evaluation mechanism may also be combined with the measuring mechanism 31 or may be formed by a separate mechanism. The formation of the effect data is described below in conjunction with the Fig. 4 and 5.

The data required for spinning on a rotor spinning machine is generated by means of yarn design software in the yarn design unit 32. This data includes both the directly effect-related data, which varies with the changing diameter of the yarn and further data relating to the basic setting of the rotor spinning machine. This is, for example, the rotor, draw-off roller and opening roller speed and the selection of the spinning means. While the latter are preferably retrieved from a table, the speeds have to be determined by corresponding algorithms. These algorithms are based on known connections. This involves, for example, the determination of the drawing from the ratio of the speeds of the take-off rollers to the speed of the take-in rollers, or of the rotations per metre from the rotor speed to the take-off speed and the constriction of the fibre assembly connected thereto.

The data generated in the yarn design unit 32 is transmitted via a data bus, the CAN-BUS 34 here, to a central control mechanism 35 of the rotor spinning machine. The transmission may also alternatively take place using transportable data carriers, such as for example a compact flash card.

The central control mechanism 35 is connected to the central computer 22 via the data line 36.

A control mechanism 25 comprises the control of, for example, 24 stepping motors 23 of the respective take-in rollers 27 via lines 24. All 24 spinning stations are constructed in the same manner. A control card 40 is connected on the control mechanism 25 by means of a connection device 39.

The data required to produce fancy yarn for controlling the stepping motors 23 is transmitted to the control card 40 via a can bus 41 by the central control mechanism 35. The control card 40, to produce fancy yarn, converts the data about thickness and length of the effects and webs, with adaptation to the conventional spinning settings, into control data for the stepping motors 23 to generate the rotational movement of the draw-in rollers 27. The data required for the control of the stepping motors of the draw-in rollers is transmitted via a can bus 42 as a continuation of the can bus 41 to further control cards, not shown, which are connected to control mechanisms of further sections of the rotor spinning machine. One of the further control mechanisms is shown by dashed lines. The further control mechanisms are constructed like the control mechanism 25, have the same connection device and the same connected control card. Each further control mechanism controls the spinning stations of a section of the rotor spinning machine, in each case.

If a stepping motor 23 is activated in such a way that it runs more quickly compared to the base speed, the draw-in roller 27 transports more fibre material to the opening roller 28. This has the result that per time unit more fibre material arrives in the rotor 6 and the thread spun becomes thicker. The length of the thick location depends on the duration of the increased fibre supply. The diameter of the thick location depends on the speed of the stepping motor 23 or the draw-in roller 27.

The control mechanism 25 is then activated via the line 43 by the central computer 22, moreover, when it is input via control commands whether the control mechanism 25

alternatively controls the production of fancy yarn or the production of effect-free yarn.

By means of one of the sensors 12, or a separate sensor, which is not drawn in here, the freshly spun yarn is measured out and the measured values transmitted to the yarn design unit 32 which is also provided with a display, not shown, in order to reproduce the current fancy yarn. If the appearance or the statistical description of the freshly spun yarn does not correspond to the original yarn, further changes have to be made. These changes may consist in changing the effect parameters which are input in the yarn design unit and in the change of further machine parameters, which are generally to be input at the central computer 22. For this, control connections 44 are available at the central computer, which may lead, for example, to a control mechanism 45 for the draw-in rollers 11 or 46 for the spinning rotors 6, the control mechanisms 45 and 46 being formed, for example, by frequency converters. A display 47 at the central computer also displays the spinning means selected which have a not inconsiderable influence on the formation of the effects.

Fig. 4 shows the view of the yarn profile of the fancy yarn as an arrangement side by side of measured values. Effects 48 and webs 49 can be seen but the beginning and end of the effects 48 and the effect thickness or the effect diameter $D_E$ and the web thickness or the web diameter $D_{ST}$ cannot be clearly seen and therefore cannot be seen adequately.

The measuring mechanism 31 registers the yarn diameter D in each case after 2 mm of yarn length. A cycle step represents a measuring length of 2 mm yarn. In the view of Fig. 5, the yarn

diameter D is shown in a percentage over the yarn length $L_G$ as a curve 50. The curve 50 represents, in the view of Fig. 5, starting from the left up to point 51, the yarn diameter $D_{ST}$. From the point 51, the curve 50 rises and at point 55 passes the value of the limit diameter $D_{GR}$. At point 53, the predetermined yarn length $L_V$ has been covered since reaching the point 52. After a diameter increase of 15% is registered at point 52, and the exceeding of the yarn diameter $G_{GR}$ lasts over the predetermined length $L_V$, for example six cycles or 12 mm, the point 52 is defined as the beginning of the effect. The curve 50 falls below the limit diameter $D_{GR}$ at the point 54. The falling below lasts up to the point 55 and therefore over the predetermined yarn length $L_V$. The point 54 is therefore defined as the end of the effect. The effect length $L_E$ is determined from the beginning and end of the effect between point 52 and point 54. An arithmetic average value is formed from the four largest diameters 56 inside the effect. The information about the effect diameter is therefore most substantially independent of the natural diameter variations in the effect region as a result. This arithmetic average value is defined as the effect diameter $D_E$.

The regions between the effects defined in this way are the webs with the basic diameter of the yarn. To determine the repeat, a number of consecutive effects and webs is initially compared with the same number of subsequent effects and webs. This number should advantageously lie below the expected repeat length. The measure of agreement contains information as to whether the sequence of effects and webs on which the comparison is based corresponds to the repeat length. For this purpose the number of effects/webs to be included in the comparison is to be successively increased. If on reaching a

certain number of effects/webs a maximum is produced, which differs significantly from the adjacent values, this value corresponds to the repeat length. The last prerequisite for reproduction of the model yarn therefore exists.